North Dakota State Engineer's Professionalism Award Nomination

Name of Nominee: William Schuh

Nominated By: Robert Shaver, Director, Water Appropriation Division

In the space provided, please complete a detailed documentation of the nominee's accomplishments relevant to the questions. Please only complete questions that you are knowledgeable of on the nominee.

1 **Describe how the nominee has routinely demonstrated the ability to perform high-quality work while supporting the Office of the State Engineer/State Water Commission's mission and goals.**

William Schuh has been employed as a Hydrologist with the Water Appropriation Division of the North Dakota State Water Commission since 1984. Initially, Bill was hired to investigate/evaluate ground water recharge with particular emphasis on flow in the unsaturated zone. After these studies were completed, Bill expanded his role to become the Water Appropriation Division "Natural Scientist." In this role he performs special studies (applied research) the results of which facilitate the regulatory functions of the Water Appropriation Division, and more recently, the Water Development Division. Attached please find a list of publications authored by Bill, most all of which have been completed during his employment with the Water Appropriation Division. As can be seen by reviewing this list of publications, Bill's scientific scope and output is on the level of many university PhD's.

Bill has designed, monitored, analyzed, and reported on a wide range of water resource related investigations ranging from artificial recharge of ground water to sources of nitrate enrichment in selected aquifers in North Dakota. His work is very thorough and rigorous, which is readily evident when one reads his publications.

Bill's work exemplifies the correct application of the "scientific method." He is quick to define a statement of the problem, develop a working hypothesis, design experiments, evaluate experimental results, and document the entire process in a comprehensive scientific report. I would venture to say that Bill is the most prolific scientific author in our agency. His research is not done just for science sake, but rather is geared toward practical applications. The state of North Dakota has benefited greatly in the realm of water-resource development and management as a result of Bill's work.

2 **Share examples of how the nominee has consistently demonstrated concern toward fellow employees and unselfishly offered assistance when help is needed.**

In 1985, Milt Lindvig and I were putting together a proposal to the U.S. Bureau of

Reclamation to evaluate artificial recharge in the Oakes aquifer as part of the Bureau's Garrison Diversion Reformulation Plan. Milt and I had concerns about how to proceed with designing, monitoring, and evaluating artificial recharge test basins. Bill overheard Milt and I discussing the proposal and he offered suggestions about using a method he was familiar with to instrument basin recharge. The method was very innovative and was applied to the recharge investigation. As a result, Bill became the lead scientist on the project that resulted in numerous scientific publications in international refereed technical journals (Water Resources Research, Journal of Hydrology).

The experience Bill gained from this study was later put to beneficial use when he worked with Jon Patch in designing an artificial recharge facility for the Park River Huttarian Colony. The local glaciofluvial aquifer was not of sufficient areal extent to accommodate Huttarian demands for additional irrigation. Bill and Jon designed and tested an artificial recharge basin facility to convey water from the Park River to the aquifer for eventual irrigation use. The facility is still operational today and will likely continue to be operational well into the future. This innovative approach to ground-water management allowed the Park River Huttarian Colony to expand their agricultural production, thereby increasing the economic activity and improving the quality of life in the area.

With the advent of specialty crop irrigation demand (primarily potatoes) during the 1990s, Bill was assigned a project to evaluate the potential for irrigation development in central North Dakota. Bill successfully collaborated with Jeff Olson to complete a report that was used extensively by public entities to expand potato production in central North Dakota. The impact on the local and state economy resulting from the increased specialty crop production was enormous. The work done by Bill and Jeff planted the seed for this eventual growth and development.

The fact that Bill's list of publications is characterized by numerous co-authors/investigators gives credence to his ability to unselfishly assist others in the pursuit of scientific understanding and knowledge.

3 **How has the nominee dependably carried out job tasks, taken the initiative to complete work in a timely manner, and exhibited a positive attitude toward the work he/she performs?**

One of Bill's best attributes is that he seeks timely closure on projects he initiates or that he is assigned. Unlike some scientists/researchers, Bill does not display "analysis paralysis." He <u>always</u> completes his studies with a formal report documenting his procedures/conclusions/recommendations in a timely manner so his colleagues may share the fruits of his labor. I again refer to Bill's publication list to support this assertion. Bill is a pleasure to work with on scientific projects. I speak with personal experience, as I was a co-project leader with Bill on the Oakes Aquifer

	Artificial Recharge Project back in the late 1980s early 1990s. Bill displays a great deal of enthusiasm on any project he becomes involved in, and this enthusiasm is contagious. If a problem arises during a project, Bill is quick to develop a solution so that the project can move forward in a timely manner. Bill has worked with many of our staff hydrologists on various water resource projects. He has worked with Jon Patch and Alan Wanek on non-point nitrate contamination problems, Mike Hove on Devils Lake outlet salinity problems and Royce Cline on artificial recharge of the Englevale aquifer. Each of these co-workers has a great deal of respect for Bill's work ethic and scientific prowess.
4	**Describe how the nominee has fostered a cooperative, respectful, and mutually satisfying work relationship with other employees and the public.** In reviewing Bill's publications list, it is clear that much of his research has been in the form of cooperative-type investigations. The list of cooperating entities is quite extensive and includes NDSU Soils Department and Extension Service, UND Department of Geology, the Energy Environmental Research Center at UND, the University of Leeds (UK), the North Dakota Department of Health, the U.S. Geological Survey and more. In addition, Bill has worked cooperatively with most of the hydrologist staff in the Water Appropriation Division. In the last few years, Bill has become an important resource for scientific problem solving in the Water Development Division. Having worked closely with Bill for 20 plus years, I have gained a great deal of respect for Bill's ability to work with others from a wide variety of disciplines to solve water resource problems. It is my firm belief that his co-workers and co-project associates outside of this agency will all agree that Bill fosters a cooperative, respectful, and mutually satisfying work relationship. With regard to public interactions, I believe he presents himself in a very professional manner. An example would be the Huttarian Colony at Park River where Bill designed and evaluated an important artificial recharge facility that will continue to increase the colony's agricultural production by efficiently applying more water to beneficial use. Without Bill's expertise in the area of artificial recharge, the colony would not have expanded their agricultural base. I know for a fact that leaders of the Huttarian Colony have a great deal of respect for Bill and what he has accomplished for the colony.
5	**Describe a work product created by the nominee, which has helped the Office of the State Engineer/State Water Commission improve services, internally and/or externally?** Recently, Bill has provided important assistance to the Water Development Division to help refine the operational plan for the Devils Lake outlet. The outlet has not been able to operate because of high sulfate levels occurring in the Sheyenne River. When Bill became aware of the problem, he and Mike Hove prepared a report that assessed historical sulfate data for the Sheyenne River, evaluated sources and

processes affecting the distribution of sulfate in the upper Sheyenne River basin, and identified data requirements needed to provide the basis for operational refinements of the outlet. Bill and Mike recognized the need for this study and spent many hours of their own time (evenings, weekends) in the analysis and preparation of their report entitled "Sources and Processes Affecting Dissolved Sulfate Concentrations in the Upper Sheyenne River." US Geological Survey personnel commented on the speed with which such a quality study was completed.

It is important to point out that a study of this nature was not within the scope of the regulatory functions of the Water Appropriation Division. Both Bill and Mike voluntarily engaged in the conduct of this study because they recognized the ramifications of not being able to operate the outlet.

This past year, Bill was approached by Bruce Englehardt in the Water Development Division to develop a soil salinity reassessment for the Devils Lake Outlet. Landowners adjacent to the outlet channel had expressed concern over potential salinization of their lands. Bill recognized time constraints and proceeded to select a method for soil salinization on a field scale that was 1) capable of strong spatial representation, 2) mapable, and 3) cost effective. The fieldwork was contracted to a local environmental engineering firm and Bill later evaluated the data and prepared a report for the Water Development Division entitled, "Methods for Reassessing Potential Soil Salinity Changes Adjacent to the Devils Lake Outlet Channel."

During this past summer, Michelle Klose met with Bill to seek resolution to a problem dealing with high alkalinity levels at Snake Creek Pumping Plant, through the pilot plant study for NAWS. Bill developed a proposal to investigate the high alkalinity problem and throughout the summer provided important insight into the local hydrogeologic environment.

In each of the above mentioned examples, Bill has responded in very timely manner to help solve problems facing other divisions in our agency. When he recognizes a problem he is very willing to offer his expertise to help solve the problem. To Bill, problems are to be solved not made! I would recommend that the committee members visit with Bruce Englehardt and Michelle Klose to question them about their interaction with Bill. I believe their comments will be very positive indeed.

6 Describe an advancement the nominee has made that has had a significant positive impact on the quality of services rendered, and/or on the Office of the State Engineer/State Water Commission's reputation.

Bill's reputation as a scientist is recognized both in internationally and within other state agencies and universities. As a result of the quality of his artificial recharge research in North Dakota, Bill was invited to participate in a special consultation work group advising Orange County, California (cost incurred by Orange County), on methods for solving problems with artificial recharge. This advisory group became aware of Bill's expertise on artificial recharge from his presentation in the

International Symposium on Artificial Recharge sponsored by the American Society of Civil Engineers in 1989.

As previously mentioned, Bill was initially hired by the Water Appropriation Division to evaluate aquifer recharge and flow of ground water in the unsaturated zone. Because of his published contributions to this field of study while employed with the SWC, Bill was invited by the U.S. Salinity Laboratory (cost incurred by the EPA) to participate in an international committee and workshop on soil hydraulic parameters.

Bill has been a co-project leader/author with researchers at UND (Professor Scott Korom) and the North Dakota Environmental Research Center (EERC) (Ed Steadman, Wes Peck, and others) and NDSU Agricultural Extension (Mike Sweeney, D. Klinkebiel and others). These cooperative investigations have dealt with unsaturated flow problems and non-point nitrate ground-water contamination. Each of these researchers has a very high regard for Bill's scientific expertise and his ability to work as part of a team to conduct scientific research.

Bill is a working committee member for the Agriculture Department pesticide management plan and co-chairman of the North Dakota state pesticide plan technical committee. He is also a reviewer and agency representative for the North Dakota Water Resource Institute advisory board. These duties have required Bill to interact with many scientists in North Dakota.

Due to the quality of Bill's scientific publications, Bill has been invited to serve and has served as a reviewer for "Soil Science Society of America Journal," "Soil Science," and "Ohio Journal of Science."

Bill has worked closely with the North Dakota Department of Health to evaluate non-point nitrate contamination in the Karlsruhe area and develop a water use plan for irrigation to mitigate nitrate contamination (Dave Glatt, Scott Radig, and others). Bill also has worked frequently with the Department of Health staff throughout the past 20 plus years addressing various ground-water contamination issues. The staff at the Department of Health hold Bill's scientific expertise and accomplishments in high regard.

The scope and quality of Bill's work has significantly enhanced the reputation of the State Water Commission as a first class investigative/regulatory agency.

7 **List any steps the nominee has taken for self improvement.**

Bill's academic training is in the field of soil science. As previously mentioned, when Bill began employment with the Water Appropriation Division, he worked strictly with unsaturated flow processes as related to natural artificial recharge. Once engaged with the artificial recharge project at Oakes, Bill began to show a great interest in the science of hydrogeology. He began to read hydrogeologic text books

and associated technical journals to improve his knowledge in this field. As part of the "self taught" process Bill began to learn and use ground-water flow models to solve selected ground-water problems (Example: use of MODFLOW in sulfatization problem in Elk Valley aquifer). In short, Bill has become a first rate hydrogeologist!

Bill has also completed a "refresher" course in differential equations at BSC to maintain his mathematical skills. In addition, Bill keeps up-to-date in the soil and hydrogeologic disciplines by reading pertinent contemporary technical journals.

12/28/06

Signature (Nominator) *Date*

Concluding Statement

In the proceeding narrative, I have tried to fully and accurately describe Bill's attributes and accomplishments that I have observed over the past 20 plus years.

I would ask that the committee carefully examine Bill's list of publications and, if possible, visit with some of Bill's co-workers within and outside of this agency. It is my firm belief that these co-workers will re-enforce my contention that Bill is an outstanding natural scientist who works well with others in and outside of his primary discipline, presents himself in a very professional manner, displays an optimistic, positive attitude in solving complex water-resource problems, and as a result, has completed state-of-the-art research that has benefited the citizens of North Dakota and enhanced the reputation of the State Water Commission. Based on the above, I nominate, without reservation, Bill Schuh for the 2006 State Engineer's Professionalism Award.

Professional Memberships and Involvement

Member: American Society of Agronomy, Soil Science Society of America, International Association of Hydrogeologists.

Has served as a reviewer: for Soil Science Society of America Journal, Soil Science, Ohio Journal of Science, Water Resources Research, Journal of Hydrology. Invited contributor to 1989 International Workshop on Indirect Estimation of Soil Hydraulic Properties, Riverside, CA. Contributor to EPA international data base on unsaturated zone hydraulic properties. Agency Representative on USEPA Section 319 project review task force. Working committee member for North Dakota Agriculture Dept. pesiticide management plan, and cochairman of the North Dakota state pesticide plan technical committee. Reviewer and agency representative for the North Dakota Water Resources Institute advisory board.

Journal Publications

Bloom, P.R., W.M. Schuh, and W.W. Nelson. 1981. Acidification of Minnesota soils by nitrogen fertilization and acid rain. Journal of the Minnesota Academy of Science. 47:6-8.

Bloom, P.R., W.M. Schuh, G.L. Malzer, W.W. Nelson, and S.D. Evans. 1982. Effect of N fertilizer and corn residue management on organic matter in Minnesota Mollisols. Agronomy Journal. 74:161-163.

Schuh, W.M., Bauder, J.W. and Gupta, S.C. 1985. Evaluation of two simplified methods for determining unsaturated hydraulic conductivity on layered soils. Soil Sci. Soc. Am. J. , 48:730-736.

Schuh, W.M. and J.W. Bauder. 1986. Effect of soil properties on hydraulic conductivity-moisture relationships. Soil Sci. Soc. Am. J., 50:848-855.

Schuh, W.M., J.W. Bauder, T. Waniger, and M. Carris. 1985. Ethaphon - a cure for winter wheat lodging in a humid area? Applied Agric. Res. 1:100-104.

Schuh, W.M. and M.D. Sweeney. 1986. Particle-size distribution method for estimating unsaturated hydraulic conductivity of sands. Soil Sci. 142:247-254.

Schuh, W.M., 1987. Apparatus for extraction of undisturbed samples on noncohesive subsoils. Soil Sci. Soc. Am. J., 51:1678-1679.

Schuh, W.M., R.L. Cline, and M.D. Sweeney. 1988. Comparison of a laboratory procedure and a textural model for predicting in situ soil water retention. Soil Sci. Soc. Am . J. 52:1218-1227.

Schuh, W.M. 1988. In-situ method for monitoring layered hydraulic impedance development during artificial recharge with turbid water. J. Hydrol. 101:173-189.

Schuh, W.M., 1990. Seasonal variation of clogging of an artificial recharge basin in a northern climate. J. Hydrol. 1221:193-215.

Schuh, W.M., and R.L. Cline. 1990. Effect of soil properties on unsaturated hydraulic conductivity pore-interaction factors. Soil Sci. Soc. Am. J. 54: 1509.

Schuh, W.M. 1991. Effects of an organic mat filter on artificial recharge with turbid water. Water Resour. Res. 27:1335-1344.

Allessi, Sam, Lyle Prunty, and W.M. Schuh. 1992. Infiltration simulations among five hydraulic property models. SSSAJ. 675-682.

Schuh, W.M. 1993. Spatial variation of root-zone and shallow vadose-zone drainage on a loamy glacial till in a sub-humid climate. J. Hydrol. 148:1-26.

Schuh, W.M. 1993. Use of an integrated transient flow and water budget procedure to predict and partition components of local recharge. J. Hydrol. 148:27-60.

Schuh, W.M. , R.L. Cline, M.J. Kosse, and D.W. Sletton. 1997. Effect of rigid PVC bailer contact on detection of pesticides in water samples. GWMR. 17:1:81-90.

Schuh, W.M., D.L. Klinkebiel, J.C. Gardner, and R.F. Meyer. 1997. Tracer and nitrate movement ot ground water in the Northern Great Plains. J. Environ. Qual. 26:1335-1347.

Schuh, W.M. and D.L. Klinkebiel. 2003. Effects of microtopographically concentrated recharge on nitrate variability in a confined aquifer: model simulations. Natural Resources Research. 12:4:257.

Schuh, W.M. and D.L. Klinkebiel. 2004. Hydraulic effects of crop management systems on nitrate variability in a confined aquifer. Natural Resources Research. 13:1:29.

Selected Publications in Proceedings

Schuh, W.M. , and R.B. Shaver. 1989. Hydraulic effect of Turbid Water Infiltration. In (ed.) A.I. Johnson and D.J. Finlayson. Artificial Recharge of Ground Water. American Society of Civil Engineers. New York. pp 85-96.

Shaver, R.B., and W.M. Schuh. 1989. Feasibility of artificial recharge to the Oakes Aquifer, southeastern North Dakota. In (ed.) A.I. Johnson and D.J. Finlayson. Artificial Recharge of Ground Water. American Society of Civil Engineers. New York. pp 74-84.

Schuh, W.M., and D.L. Klinkebiel. 1994. A study of water and tracer movement to the Carrington aquifer. In (ed.) Bruce Seelig. Proceedings of the North Dakota Water Quality Symposium. Fargo, ND. NDSU Cooperative Extension Service, Fargo, ND. pp 103-111.

Schuh, W.M., Klinkebiel, D.L., and B.D. Seelig. 1996. Short-term effects of conventional, biological, and integrated agricultural management systems on ground-water recharge, and nitrate and pesticide movement under conditions of dryland farming. Proceedings of the North Dakota Water Quality Symposium. NDSU Extension Service. Fargo, ND.

Other

W.M. Schuh. 1989. Calibration of Soil Hydraulic Parameters Through Separation of Subpopulations in Reference to Soil Texture. In (ed.) M. Th. van Genuchten, F.J. Leig, and L.J. Lund. Proceedings of the International Workshop on Indirect Methods for Estimating the Hydraulic Properties of Unsaturated Soils. Riverside, California, October 11-13, 1989. U.S. Salinity Laboratory, USDA-ARS. Riverside, CA. pp 489-498.

Selected Reports and Publications

Schuh, W.M. and R.L. Cline. 1987. Compendium of selected North Dakota unsaturated flow data in functional format. Water Resources Investigation No. 4, North Dakota State Water Commission. Bismarck, ND.

Schuh, W.M. and Robert B. Shaver. 1988. Feasibility of artificial recharge to the Oakes aquifer, southeastern North Dakota: evaluation of experimental recharge basins. Water Resources Investigation No. 7. North Dakota State Water Commission. Bismarck, ND.

Sumner, D.M., W.M. Schuh., and R.L. Cline. 1991. field experiments and simulations of infiltration rate response to changes in hydrologic conditions for an artificial recharge test basin near Oakes, southeastern North Dakota. Water-Resources Investigations Report No. 91-4127. U.S. Geological Survey. Bismarck, ND.

Schuh, W.M., R.L. Cline, and M.D. Sweeney. 1991. Unsaturated soil hysraulic properties and parameters for teh Oakes area, Dickey County, North Dakota. Water Resource Investigation No. 18 North Dakota State Water Commission. Bismarck, ND.

Schuh, W.M., R.L. Cline, M.J. Kosse, and D.W. Sletton. 1993. Review and experimental evaluation of effects of short-term PVC contact and distilled water wash procedures on measured pesticide concentrations in field samples. Water Resource Investigation No. 24. North Dakota State Water Commission. Bismarck, ND.

Cline, Royce, Craig Odenbach, Preston Schutt, and William Schuh. 1993. Feasibility of stabilization of water levels and expansion of water use from the Englevale aquifer using water conservation, well field modification, and artificial recharge.

Water Resource Investigation No. 23. North Dakota State Water Commission. Bismarck ND.

Schuh, W.M. 1994. Planning, construction, and initial sampling results for a water quality monitoring program: Camp Grafton South Military Reservation, Eddy County, North Dakota. Water Resource Investigation No. 27. North Dakota State Water Commission. Bismarck ND.

Schuh, W.M., D.L. Klinkebiel, R.F. Meyer, M.D. Sweeney, J.C. Gardner, and A.R. Wanek. 1994. Agricultural impact on water quality in a shallow confined aquifer and in the overlying saturated glacial till in eastern North Dakota: movement of water and tracers. Water Resource Investigation No. 28. North Dakota State Water Commission. Bismarck ND.

Schuh, W.M., D.L. Klinkebiel, R.F. Meyer, M.D. Sweeney, J.C. Gardner, and A.R. Wanek. 1995. Agricultural impact on water quality in a shallow confined aquifer and in the overlying saturated glacial till in eastern North Dakota: movement of pesticides. Water Resource Investigation No. 32. North Dakota State Water Commission. Bismarck ND.

Schuh, W.M. 1994. A survey of affects and sources of hydraulic loading on water table conditions in the city of Pingree in 1993 and 1994. Response to the Emergency Declaration of the City of Pingree, sent to the North Dakota State Office of Emergency Management (Dated May 5 1994).

Klinkebiel, D.L., W.M. Schuh, and B.D. Seelig. 1994. Report of the Carrington SARE-ACE Experiment, 1992-1993: I. influence of agricultural management practices on agronomic parameters.

Schuh, W.M., D.L. Klinkebiel, and B.D. Seelig. 1994. Report of the Carrington SARE-ACE experiment, 1992-1993: II. effect of agricultural management practices on ground-water quality.

Olson, D.M. and W.M. Schuh. 1995. Inventory of potential irrigation development in Central North Dakota. North Dakota State Water Commission. Bismarck, ND.

Schuh, W.M. 1995. Analysis of evidence concerning the risk of contamination of the Elk Valley aquifer from elevated sulfate concentrations.

Schuh, W.M. 1997. Water quality evaluation for the North Dakota National Guard Camp Grafton (South Unit), Eddy County, North Dakota: 1996 sampling. Water Resource Investigation No. 33. North Dakota State Water Commission. Bismarck, ND.

Schuh, W.M. 2002. Water quality evaluation for the North Dakota National Guard Camp Grafton (South Unit), Eddy County, North Dakota: 2001 sampling. Water Resource Investigation No. 37. North Dakota State Water Commission. Bismarck, ND.

Schuh, W.M., R.L. Cline, and M.D. Sweeney. 2005. Infiltration data and functions, and soil moisture and matric potential data during wetting for selected soils in the Oakes area, Dickey County, North Dakota. Water Resource Investigation No. 18-A North Dakota State Water Commission. Bismarck, ND.

Publications Addendum (2006)

Schuh, W.M., S.F. Bottrell, and S. F. Korom. 2006. Sources and Processes Affecting the Distribution of Dissolved Sulfate in the Elk Valley Aquifer in Grand Forks County, Eastern North Dakota. Water Resources Investigation No. 38. North Dakota State Water Commission. Bismarck, ND. 132 pp.

Schuh, W.M. and M.H. Hove. March 22, 2006. Sources and Process Affecting Dissolved Sulfate Concentrations in the Upper Sheyenne River. North Dakota State Water Commission Open File Report. 55 pp.

Schuh, W.M. 2006. Methods for Reassessing Potential Soil Salinity Changes Adjacent to the Devils Lake Outlet Channel. Water Resources Investigation No. 39. North Dakota State Water Commission. Bismarck, 51 pp.

In Preparation:

Initial assessment reports for:
(1) Initial ground-water assessment for wells placed to evaluate potential soil salinization along the outlet, from recommendations of Western Plains Consulting; and
(2) Evaluation of Stump Lake on ground-water in Tolna Coulee.